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ABSTRACT

The research on cooperative scripts is brought together using a model that provides an overview of the learning processes involved and the outcomes to be expected from the use of certain scripts. By providing such a framework, the wealth of research may be compared and generalized, thereby promoting its instructional utility. The Cognitive Engagement in Cooperative Learning model is explained, and then common cooperative learning strategies and scripts are reviewed in relation to the model. The model illustrates how enhanced learning is the result of the type and amount of cognitive engagement involved in a particular cooperative learning script. Evidence used to build the model suggests that scripts that promote basic organizational strategies or simple elaboration techniques will not be as effective for learning as higher-level elaborative and reconstructive scripts. The practical use of the model is to give instructors a broad idea of the types of learning outcomes to expect given certain scripts. Finally, the limitations of the model are discussed, and recommendations are made for future research. (Contains 1 figure and 57 references.) (SLD)

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Cognitive Engagement in Cooperative Learning

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Abstract

This purpose of this paper is to bring together the abundance of research on cooperative scripts using a model that provides an overview of the learning processes involved, and the outcomes to be expected from the use of certain scripts. By providing such a framework, the wealth of research may be compared and generalized, thereby promoting its instructional utility. First, the Cognitive Engagement in Cooperative Learning model is explained. Then, common cooperative learning strategies and scripts are reviewed in relation to the model. Last, limitations of this model are discussed and recommendations are made for future research.

Cognitive Engagement in Cooperative Learning: A Model

Background and Use of Cooperative Learning

Many educators who use cooperative learning methods do so because they view their students as active discovers and creators of knowledge. The educational process is viewed from this paradigm as a joint collaboration between the instructor and the student, in which the instructor serves to develop students' competencies and talents through the use of more active learning methods (Cooper, 1993, King 1993). By reconceptualizing the educational process in this manner, students will be better suited for life in the twenty-first century, in which they will be expected to take more responsibility at earlier ages, to think and solve complex problems and to sort through information and produce knowledge rather than merely reproduce it (King, 1993). In the global society of tomorrow, the learning process will be fundamentally linked to social interaction that goes well beyond the traditional teacher-student information-transmission relationship. In such an educational environment, students and teachers will work cooperatively between and among themselves, instead of individualistically or competitively, as they would have under the previous paradigm (Cooper, 1993).

Cooperative learning has served as a valuable instructional tool for many years, and will very likely become even more foundational in light of the rising constructivist paradigm in education (Bredehoft, 1991; Cooper, 1993; King, 1993; Rhem, 1992). Cooperative learning has been suggested as a valuable instructional alternative to traditional passive means of learning such as listening to and taking notes during a lecture (Bonwell & Eison, 1991; Johnson, Johnson & Smith, 1991; Whitman, 1988). The popularity of cooperative learning has also lead to a great deal of research in the area. In fact, Johnson, Johnson & Smith (1991) point out that during the last 90 years, over 575 experimental studies (as well as hundreds of correlational studies) have compared the effectiveness of cooperative, competitive and individual approaches to learning.

There are three ways that cooperative learning differs from traditional learning scenarios: (1) it involves two or more people learning material together; (2) participants play equal roles as peers (instructor's role is minimized); and (3) presumably, none of the learners are experts in the material to be learned (Hall, Rocklin, Dansereau, Skaggs, O'Donnell, Lambiotte & Young, 1988). Under this broad definition of cooperative learning there can be many types of cooperative structures, such as dyads, rotated peer-teaching situations, reciprocal questioning groups, discussion groups and problem-solving groups. Those familiar with cooperative learning methods may use names for different structures such as cooperative integrated reading and comprehension (CIRC), co-op co-op, cooperative controversy, descubrimiento, jigsaw, learning together,

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numbered heads together, student team learning (STL), student teams-achievement divisions (STAD), teams-games-tournament (TGT), team assisted individualization (TAI), and think-pair-share (Kagan, 1989; Robinson, 1991; Slavin, 1991). Using structures such as these, cooperative groups may participate in various learning activities such as reviewing, summarizing, clarifying, explaining, questioning, debating, or reaching consensus.

Structuring Cooperative Groups for Maximum Benefit

Researchers have found that particular learning outcomes can be predicted as a function of the design or structure of the learning groups (Hall et al., 1988; Kagan 1989/1990; King & Rosenshine, 1993; Lambiotte, Dansereau, O'Donnell, Young, Skaggs, Hall & Rocklin, 1987; Larson, Dansereau, O'Donnell, Hythecker, Lambiotte & Rocklin, 1985; Lew, Mesch, Johnson & Johnson, 1986; O'Donnell & Dansereau, 1992; 1993; Sharan, 1980; Smith, Johnson & Johnson, 1981). Therefore, when considering the use of a cooperative learning strategy, an instructor should consider the structure of the learning task and the learners' activities in light of the material to be learned (Dees 1991; Kagan 1989/1990; King 1991; Lambiotte et al., 1987). For instance, King (1991) found that the use of "guided questioning" within cooperative learning groups of fifth graders working with computer-assisted problems significantly enhanced learning compared to those who did not use guided questioning.

The term script has been adopted by many researchers to describe the formal directions that a cooperative learning group or dyad would use to structure their activities (Lambiotte et al., 1987). A script outlines the learners' activities in detailed description and specifies the goal for group members to achieve. For instance, group members would not be told only to discuss a certain topic, but to discuss it and decide on the three most relevant points. In the structure called Student Teams Achievement Division (Slavin, 1986), learners are told not only to quiz each other about the material, but to continue quizzing and discussing until everyone in the group understands the material thoroughly. Students are then held individually accountable on a subsequent test, and teams are rewarded when group members do well. Other types of scripts might include directions for a group to read a passage and cover a series of related questions, or engage in a debate using a specified format and certain positions, or any of an unlimited number of activities designed to engage the learner in the learning process with the specified material. For the purposes of convention, the term script will be used here although cooperative group activities in related literature may not have been designated as such.

A series of studies conducted by O' Donnell, Dansereau and colleagues (Dansereau, 1985) over the last fifteen years have described many ways that scripts have been manipulated to produce various learning outcomes (Dansereau, 1983; 1985; Hall, et al., 1988; Lambiotte et al., 1987; Larson, et al., 1985; McDonald, Larson, Dansereau & Spurlin 1985; O'Donnell & Dansereau, 1992; 1993; O'Donnell, Dansereau, Hall & Rocklin 1987; O'Donnell, Dansereau, Hythecker, Hall, Skaggs, Lambiotte & Young 1988; O'Donnell, Dansereau, Rocklin, Hythecker, Lambiotte, Larson & Young 1985; Spurlin, Dansereau, Larson & Brooks, 1984). For instance, Dansereau (1983; 1985), McDonald and colleagues (1985), O'Donnell and colleagues (1987), and Spurlin and colleagues (1984) examined the effects of a multiple summarization and corrective feedback script for learning expository text. O'Donnell, and colleagues (1988), on the other hand, compared prompting, preplanning, planning, and distributed planning scripts for use with learning a medical procedure. Further examples of script usage include scripts for learning text, lectures or procedures using strategies such as review, elaboration, multiple-step study strategies or reciprocal teaching (Hall et al., 1988; Lambiotte, et al., 1987; Larson, et al., 1985; O'Donnell, et al., 1985; O'Donnell & Adenwalia, 1989; O' Donnell & Dansereau, 1993).

Both Johnson and colleagues (1991) and Slavin (1989) indicate that cooperative learning is one of the most thoroughly researched instructional methods. Research on the use of scripts in

cooperative learning, on the other hand, is a fairly recent development. From a researcher's standpoint, the use of scripts in recent cooperative learning research has served to create satisfactory experimental control over learning activities so that those activities may be repeated consistently and learning outcomes may be predicted with more reliability. Even though research demonstrates consistent effects for the use of certain scripts on particular outcomes, the breadth of research still lacks theoretical unity. In order to move from the script development that is taking place in the research literature to active and frequent use in the classroom, instructors need to be able to understand how to use scripts, why they work, and what can be expected from their use.

This purpose of this paper is to bring together the abundance of research on cooperative scripts using a model that provides an overview of the learning processes involved, and the outcomes to be expected from the use of certain scripts. By providing such a framework, the wealth of research may be compared and generalized, thereby promoting its instructional utility. First, the Cognitive Engagement in Cooperative Learning model is explained. Then, common cooperative learning strategies and scripts are reviewed in relation to the model. Last, limitations of this model are discussed and recommendations are made for future research.

The Cognitive Engagement in Cooperative Learning Model

The Cognitive Engagement in Cooperative Learning (CECL) model was created as a means of conceptually integrating the breadth and variety of research concerning cooperative learning scripts and corresponding learning outcomes. It is assumed in the CECL model that learning in cooperative groups is facilitated by two factors. The first factor is related to the type of cognitive processing, or the "construction" of connections in memory. Such connections are made in one of two ways: either by organizing or elaborating (Weinstein & Mayer, 1986). Effective organization is the process of structuring information in such a way that maximum inferences can be made from knowing a minimum of the information (Anderson 1990). Creating outlines, diagrams, hierarchies and matrices are types of organizational processes; they imply categorizations that do not need to be rotely and individually memorized. Elaboration is the process of associating or connecting new information with information that is already known, such as relating it to similar ideas studied previously (Anderson, 1990, Driscoll, 1994). Examples of basic elaboration strategies include asking questions, using mnemonic techniques, using keywords or illustrations, rehearsing of items in a list, copying or underlining material, forming a mental image, or writing a sentence to relate items (Weinstein and Mayer, 1986). In basic elaborative and organizational strategies, the emphasis is on creating associations within the material to be learned (Weinstein and Mayer, 1986). More complex elaborative strategies include paraphrasing, summarizing, creating analogies, generative notetaking, and question answering (Weinstein and Mayer, 1986). Elaboration strategies, like these more complex ones, are more effective when the learner integrates the presented information with prior knowledge (Weinstein and Mayer, 1986). In this fashion, the material to be learned is associated, or connected, to existing structures of known information, thus creating deeper processing and multiple retrieval routes and therefore greater learning (Anderson, 1990, Baddeley, 1990, Driscoll, 1994).

The second factor that facilitates learning in cooperative groups is related to the amount of cognitive processing, or the engagement of the learner with the information to be learned. Just as information is organized and elaborated upon for it to be learned initially, it also can be pulled out, reorganized and reelaborated upon, especially in light of new information. This process of reorganizing and reelaborating upon information is called "reconstruction" (Bartlett, 1932; Driscoll, 1994). The "challenge" that drives the reconstruction process can come in the form of discrepant information, or from the differing perspective that a peer may bring to the learning situation. This challenge may cause learners to rethink, reassess, or restructure their thinking about a particular issue or belief. This process is similar to Piaget's (1985) notion that humans conduct a process of

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trying to reduce disequilibrium in the presence of challenging new information, that is, they try to cognitively accommodate the discrepant information. Thus, the more that the learner is engaged with the material to be learned, the more learning will take place. At its deepest level, engagement involves a reconstruction of previously held structures of information.

To clarify construction and reconstruction, consider the following example: When a student listens to a lecture and takes notes, the note-taking is a process of organizing the information to be learned, that is, the information is structured more efficiently for better learning. A cooperative learning script that focuses on the organization component might call for pairs to work together to create a set of notes based on the lecture. A different type of script might call for elaborative processes. Suppose the student were given instructions to take notes individually, but relate those notes to a peer in their own words. In explaining them in their own words, the student is now elaborating, that is, they are making connections between the information to be learned and their own system of previously learned knowledge. A third type of script might go farther with the peer dialogue and instruct the students to ask for clarification from their partner or to point out discrepancies with their own notes. In attempting to clarify or answer the discrepancy, the explaining student then must recall the information and reorganize or reelaborate upon it to make it clear to the peer. In reorganizing and reelaborating, the student is now reconstructing the information.

Literature concerning the cognitive processing involved in cooperative learning has discussed the importance of reconstruction. King's (1991) socio-cognitive theory suggests that an individual's reconstruction of knowledge is facilitated through peer interaction because it is during interaction that, "conflicting ideas and differing perspectives arise and are reconciled" (King, 1991, p. 315). Generating coherent answers to the questions of peers stimulates a series of cognitive responses that might not occur otherwise. Webb (1989) explains this process as follows:

> In explaining to someone else, the helper must clarify, organize, and possibly reorganize the material (see Bargh & Schul, 1980). [The helper] may discover gaps in his or her own understanding or discrepancies with others' work or previous work [and] may search for new information and subsequently resolve those inconsistencies, thereby learning the material better than before...[Occasionally] the helper is forced to try the formulate the explanation in new or different ways. This may include using different language... generating new or different examples, linking examples to the target student's prior knowledge or work completed previously, [or] using alternative symbolic representations of the same material. (p.29)

Thus, in attempting to answer a question from a peer, or resolve a conceptual conflict, an individual calls relevant information into mind and works to construct an explanation, and in answering further questions may reconstruct such explanations to account for the differing perspective of the questioner.

In cooperative learning, the greatest degree of engagement takes place when learners' prior knowledge or reasoning processes are challenged. The challenge may come in the form of a direct question from a fellow student or the instructor, or it may be more indirect when the material itself is challenging. In particular, cooperative groups in which the script calls for learners to view concepts from differing perspectives, or in which the learners themselves hold alternative perspectives may be especially effective learning environments. In addition, if such perspectives are presented and an attempt is made for mental reconciliation then the learning outcomes should be enhanced further. Mannes (1994) presents evidence that critical thinking and stronger inferential thinking about material can be promoted when the same information is presented from two alternative perspectives. She suggests that having to contend with material from a different perspective is cognitively consuming, but will result in richer domain representation. In the same way, peer teachers have been shown to have increased learning after teaching compared to just

before teaching, suggesting that in the teaching activity itself there is an elaborative/ reconstructive process that can be explained by the teacher engaging with the differing perspectives of his or her learners and coming to a broader, more integrated representation of the knowledge (Whitman, 1988). Directly engaging and reconstructive activities include debates (Johnson and Johnson 1989), cooperative controversy (Bredehoft, 1991), cognitive conflict (Dale, 1992). Indirect challenges are seen more when the controversy is not explicitly built into the learners' activities, but may very likely happen in the course of trying to learn from their peers, such as in peer teaching (Whitman, 1988) or collaborative writing (Golub, 1988).

The Cognitive Engagement in Cooperative Learning Model

The Cognitive Engagement in Cooperative Learning (CECL) model is based upon the type of encoding, or construction strategies (organization and elaboration) and the amount of engagement that would theoretically take place given a certain type of script. Along the left-to-right continuum of the model (Figure 1), scripts can be placed according to the constructive and reconstructive processes that they promote in cooperative groups. At the far left end of the continuum are those scripts which promote simple organization, with elaboration scripts coming next. At the far right end of the continuum are those scripts in which reconstruction is an major part of the learning activity. Since complex elaboration builds on organizational activities, it is by definition more effective than organization alone, and therefore follows the organizational schemes. For conceptual simplicity, the model progressively arranges the continuum of cognitive engagement into four categories: Simple Organization, Complex Organization/ Simple Elaboration, Complex Elaboration and Reconstruction. Because elaboration and organization are both methods of encoding, they are not easily separated; therefore, this model allows for their overlap in the second category

Simply stated, this model illustrates how learning is affected by scripts. The left-to-right continuum represents the type and amount of construction in learning in relation to the given scripts. The following section will present an overview of the many types of scripts used in cooperative learning, and where they might be placed along the CECL continuum. In figure 1, scripts located within the same row are directly compared. In addition, indirect comparisons can be made between rows in relation to the type and amount of cognitive construction involved in the scripts. For instance, the script for guided questioning (a complex elaborative activity) can be indirectly compared to a note-taking script (a simple organizational activity).

Cooperative Learning Strategies Applied to the Model

The cooperative learning structures and strategies reviewed here focus on the various kinds of scripts used in cooperative groups and places these scripts along the cognitive engagement in cooperative learning continuum. Scripts within each bar of Figure 1 are arranged left-to-right in order of type and amount of engagement involved, which also correspond, theoretically, to enhanced learning outcomes.

Cutting across the Continuum: Peer Teaching Scripts

Peer teaching illustrates how cognitive engagement takes place at all levels, beginning with simple organization (Figure 1). Learners who anticipated a peer teaching situation, but did not actually teach, demonstrate constructive (encoding) processes-- without the reconstruction that takes place during the actual teaching situation. For example, Bargh and Schul (1980) found that college students preparing to teach someone else produced more highly organized cognitive structures, and thus performed better on an achievement test, even before they did their teaching. Similarly, Benware and Deci (1984) hypothesized that the psychological processes involved in preparing to teach were different than those required to learn it. They found that those college

students who were told they were to teach the content of an article but did not actually teach had significantly higher scores two weeks later for conceptual understanding than those who were only told that they would be tested later. Both groups, however, did equally well on a test of rote memory. Benware and Deci (1984) speculate that the deeper processing may happen as a result of either increased intrinsic motivation, or because of more active mental engagement. Thus, engagement happens at a much deeper level when students think that they will be needing to explain material to a peer, perhaps because the construction actually uses much more organization and elaboration han is normally used when learning material. These examples serve to illustrate the difficulty in separating organizational effects from elaboration effects.

After reviewing the material to be taught, and organizing its presentation, peer teachers then move into the actual teaching situation and their cognitive processing changes qualitatively as they seek to elaborate on the material in a more complex, or thorough manner for the sake of their target audience's comprehension (Whitman, 1988). Such elaboration may be a combination of low-level and high-level elaboration techniques such as providing simple examples or clarification to helping the audience to integrate the material with prior knowledge. Elaboration in the context of a peer teaching situation can have more effective learning outcomes than individual elaboration. Whitman (1988) cites several studies in which peer teachers who prepared to teach and then taught outperformed those who only prepared to teach. Thus, there is a further, or deeper constructive process that takes place in conducting the teaching that serves to supplement the learning. In addition to the positive outcomes of constructive processes, Whitman (1988) suggests that significant learning outcomes may occur when the teacher is challenged to reintegrate or reorganize information, as a type of reconstructive process. Thus, peer teaching has the potential to move a learner through all of the levels of cognitive processing from simple organization to reconstruction, and serves as an effective learning script for cooperative groups.

Simple Elaborative Scripts: Summarization/ Recall Scripts

McDonald, Larson, Dansereau and Spurlin (1985) provided evidence for the notion that simple elaboration in a cooperative group can be more effective than individual learning. They tested the contention that a lack of transfer from cooperative learning to individual learning was the result of poorly structured cooperative interactions (McDonald et al., 1985). They felt that designating specific learning and interaction strategies in cooperative learning groups would enhance the transfer process. One group who used a script was compared to a group that did not and to individuals who either used the same script alone, or used their own methods. The script used in this case asked learners to read a passage (dyads read the same passage) and to stop, recall and summarize the information after approximately 500 words. Partners in the dyads were to help correct errors in the recall and summarization and to facilitate elaboration on the material. Summarizers were questioned in remediating their errors and were questioned in trying to develop effective elaborations on the material.

Using a series of three experiments designed to eliminate additional variables affecting task performance, they discovered that pair interaction, combined with the questioning strategy, resulted in greater initial learning and positive transfer on a subsequent individual learning task than the other three conditions involving pair interaction with no explicit strategy, individual study with the questioning strategy or individual study with no explicit strategy. Not only do these results provide evidence for the efficacy of cooperative learning, they also show the superiority of elaboration over organization. Since the questioning strategies were taught prior to the exposure to the material, construction in the two strategy groups should have been equal. Yet, it was shown that the dyads outperformed the individuals; therefore, something more than organization took place in the students that had been taught strategies. Thus, they concluded that, "it is not the strategy or the pair interaction alone which contributes to the transfer effect, but a combination of

the two which enhances an individual's solitary learning..." (McDonald et al., 1985, p.373). Even though higher-level thinking processes are not involved in summarization and error correction, this study showed that such simple elaborations can be more effective than individual learning (Figure 1).

Whereas, in the McDonald and colleagues (1985) study, the presence of summarization in a group lead to enhanced learning outcomes, Spurlin, Dansereau, Larson and Brooks (1984) show that the amount of summarization leads to different learning outcomes. Simply stated, they found that within three cooperative groups, those students who spent all of their time summarizing outperformed those students who spent half of that time summarizing, who in turn outperformed those who only listened (Figure 1). Thus, the quality of the learning is also a function of the amount of active elaboration each individual makes within a cooperative group. Although being a member of a cooperative group may help learning, that learning can be enhanced by scripting the group activities so that the learners each engage in constructive processes.

Simple Elaborative Scripts: Imagery, Mnemonics, Analogies and Personalization Scripts

Although simple elaborations can be effective for learning in cooperative groups, one hypothesis for the learning gains in a group has to do with the metacognitive activities that occur in such a situation, such as error correction, detecting omissions and comprehension-monitoring. Larson, Dansereau, O'Donnell, Hythecker, Lambiotte and Rocklin (1985) conducted a study to compare how a metacognitive script might compare to a simple elaboration script and a control group script. They found that groups trained in metacognition initially scored well on a recall task, but the groups trained in the use of imagery, mnemonics, analogies and personalizing information carried their learning into individual learning tasks after five days. Both groups also outscored the control group that engaged in an alternating recall task (Figure 1). Although metacognition is a monitoring activity and thus does not fit into the CECL model as a processing activity, it does serve as an alternative explanation for cooperative group learning gains. The fact that the metacognitive group had more enhanced learning outcomes than the control group indicates that this is an important topic for further study. However, on the basis of this study, the effectiveness of a metacognitively-oriented script seems to be inferior to a simple elaboration script. How much more learning can occur then, if the script uses higher-level elaboration or reconstructive activities? The Larson and colleagues (1985) study serves to illustrate how important it is to concentrate on both the type and amount of cognitive processing when designing a script compared to the possible benefits of manipulating metacognitive activities.

Simple Elaborative Scripts: Reciprocal Teaching Scripts

Reciprocal teaching is a method that has become popularized for use in promoting reading comprehension, especially among primary school children (Bruer, 1993). The primary research in this area has been conducted by Palinscar and Brown (1984; 1987; 1989, 1992). In reciprocal teaching, instructors first model a method of summarizing, questioning, clarifying and predicting in relation to a target text, and then gradually ease their students into using the methods themselves in cooperative group situations. Palinscar and Brown (1984) found that students who used this script had substantial comprehension gains, marked by maintenance over time, generalization to classroom comprehension tests and standardized tests and transfer to novel tasks that used the skills of summarizing, questioning and clarifying.

Whether or not reciprocal teaching is a simple or complex elaboration process, and how much reconstruction might occur as a result of the group interaction is a function of the learners and the material of study. In Palinscar and Brown's (1984) study, the students were from the seventh grade, in a remedial reading program. The activities that the students were scripted to use were oriented mostly for one-way communication from the learners to their peers, as the learners

summarized, presented a potential test question, clarified difficult points and made predictions about what might happen next. Peers were able to ask for explanation or clarification, if they needed it. These tasks, are mostly simple elaboration tasks, and thus the reciprocal teaching script is placed in this category in the model (Figure 1). If further research was conducted using older students or more complex topics of study, then reciprocal teaching could easily start to incorporate higher-level learner activities. For instance, given a group of learners that are college level, in which the material to be learned may be seen from differing perspectives, it is possible for learner activities to be comprised of complex elaboration strategies to integrate, analyze and synthesize for an effective summary or explanation. Reciprocal teaching, in this situation, might then start to look more like peer teaching or peer tutoring, as these terms are used in research literature (Bonwell & Eison, 1991; Whitman, 1988).

Although reciprocal teaching as it is currently used is a simple elaboration strategy, peer teaching, its counterpart, typically involves many higher-order thinking skills. If a distinction was made between the two, other than the fact that reciprocal teaching is typically used with younger learners and specifically involves the four processes of summarizing, questioning, clarifying and predicting, then the distinction should be that peer teaching is a broader term and applies to situations in which many critical thinking strategies are involved (Whitman, 1988).

Complex elaboration: Questioning scripts

Although simple elaborations may help in learning material, scripts that promote higher-level, or more complex, thinking should be more effective. Complex thinking is related to identifying and interpreting central issues and assumptions, recognizing important relationships within information, making inferences, deducing conclusions, amd making evaluations (Terenzini, Springer, Pascarella & Nora, 1995). The more internal connections within the material and the more external connections to prior knowledge that the learner makes, the more effective the learning will be (King, 1992).

Lambiotte, Dansereau, O'Donnell, Young, Skaggs, Hall and Rocklin (1987) provide support for the notion that complex elaborative activities will lead to enhanced learning outcomes. In their study, they tested the learning outcomes of scripts in which college students either read the same passage and then summarized and discussed it (termed the cooperative learning group), or in which learners read different passages to summarize and discuss (termed the cooperative teaching group). A third condition was introduced as well, meant to serve as a midpoint between having no prior exposure to the material for one partner to equal prior exposure. In this condition (termed cooperative microteaching), the passage was divided such that partners would read and teach every other section to each other. The results showed more positive learning outcomes for the cooperative teachers than for the cooperative learners, with the cooperative microteachers performing in between (Figure 1). Thus, it would appear that preparing for and teaching material to a partner with little or no exposure to the material is a powerful method of remembering that information. The cooperative learning group in this study is likened to the typical cooperative learning group in the classroom in which all the learners in a group have exposure to, or have read the same material (Lambiotte et al., 1987). Although this "read and discuss" script may be effective, this study provides evidence that other scripts may be more effective.

The Lambiotte and colleagues (1987) study also illustrates the effectiveness of higher-order construction compared to the simple elaboration that discussion can provide. Lambiotte and colleagues (1987) suggest one reason for the success of the two teaching scripts is that, "the knowledge that they cannot access the information except through the partner may cause learners to ask more questions and more thoughtful questions" (Lambiotte et al., 1987, p.429). Thus, they link the enhanced learning outcomes of peer teaching to asking thoughtful (higher-order) questions.

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Alison King (1989; 1990; 1991; 1992) has conducted a number of studies which examine specifically the effects of questioning, both in individual and group learning. In King (1989) she tested the effect of self- and peer-questioning on college students' comprehension of lectures. The questioning script she used involved training students in the use of "question stems" derived from higher levels of Bloom's (1956) taxonomy. Thus, the elaboration involved here is of a higher-level, both in the groups and for individuals who use self-questioning. In comparing students in the four conditions of self/peer questioning in cooperative groups, independent self-questioning, review in cooperative groups and independent review, she found that students in both of the self-questioning conditions performed equally well on measures of lecture comprehension and significantly outperformed either of the two review conditions (Figure 1). Thus, her findings here illustrate the effectiveness of a questioning strategy, but do not show improved outcomes for using cooperative groups.

There are several reasons why the use of cooperative groups may not have enhanced the learning processes. Cooperative groups can serve several purposes in enhancing learning. One purpose of a cooperative group, proposed here, is that cooperative groups serve as a catalyst for the construction and reconstruction process by providing for alternative perspectives. Not all cooperative learning scripts promote alternate perspective taking, or the content of study may not lend itself to differing perspectives. That may be the case in the King (1989) study, and therefore, self-questioning was as effective as peer-questioning. Another reason that the learning may have been equally effective was that the questioning strategy actually served more as an encoding strategy for the lectures following the training. In this situation, elaboration took place during the lectures and was thus unaffected by subsequent activities, whether individual or group. Either explanation for the equal effectiveness of the group and individual questioning strategies seems coherent, and is in line with the hypotheses of the proposed model.

Continuing her research on the learning outcomes of questioning scripts, King (1990; 1991) found some notable results that give substantial support to the CECL model. Although her previous research showed questioning in cooperative groups to be an effective learning strategy, she was unable to dispel the notion that her guided questioning strategy was more than just another means of simple elaboration. In other words, was the mere presence of questioning in a group enough to promote enhanced learning, or was learning more a consequence of the quality of the questioning? In King's 1990 and 1991 studies, she compared groups of students that used a guided questioning strategy, which requires students to explain and justify their thinking, to groups which were told to use questions with no training (unguided questioning) and groups that were not given any explicit instructions. The guided questioning groups not only outperformed the unguided groups on a measure of lecture comprehension (1990) and problem solving (1991), but they also used significantly more critical-thinking questions (Figure 1). In fact, King (1990) found that students in the unguided questioning group did not spontaneously generate higher-level questions even when prompted to ask each other questions. Thus, it would seem that quality of questioning impacts the amount of learning that takes place in a cooperative group and that the use of a guided questioning script can facilitate enhanced outcomes.

Complex Elaboration: Elaborative interrogation scripts

Recent research into elaborative interrogation lends additional support to the notion that when learners are asked to explain and justify their thinking (higher-order thinking), then there will be greater learning performance (Martin & Pressley, 1991; Pressley, Wood, Woloshyn, Martin, King & Menke, 1992; Willoughby, Wood & Khan, 1994; Woloshyn, Paivio & Pressley, 1994). Elaborative interrogation is the process of connecting novel information to prior knowledge using "why" questions concerning the new material (Willoughby, Wood & Khan, 1994). "Why" questions, as higher-order types of questions, can be particularly effective in promoting learning of

the new material (Martin & Pressley, 1991; Pressley, Wood, Woloshyn, Martin, King & Menke, 1992; Willoughby, Wood & Khan, 1994; Woloshyn, Paivio & Pressley, 1994). Research in the use of elaborative interrogation, like King (1990; 1991), has found that the quality of the questions that are asked may have differential learning outcomes (Martin & Pressley, 1991).

In the studies on elaborative investigation mentioned in this paper, the researchers used this strategy only in individual learning situations. This strategy is discussed because it is an effective elaboration technique that uses higher-order processing and, as such, holds great potential for use in a cooperative script. By including elaborative interrogation in this model, it illustrates how complex elaboration compares to other levels of cognitive processing (Figure 1).

Reconstructive Scripts

The previous sections have served to illustrate the point that constructive processes of organization and elaboration within cooperative groups have differential outcomes on learning depending upon the type and amount of cognitive engagement involved. It is proposed here that the learning outcomes can be enhanced even further by incorporating activities into a cooperative script that promote active reconstruction of information. Such activities might occur in the context of a group where different perspectives are encouraged or where learners are challenged by their peers to rethink their comprehension.

Reconstructive Scripts: Controversy scripts

Johnson and Johnson (1991) have conducted a great deal of research into an area they call "structured academic controversy." They contrast this cooperative strategy with debates, individualized controversy and concurrence-seeking (Johnson & Johnson, 1989). Both debates and structured academic controversy are reconstructive in their nature, and are included in Figure 1. Smith, Johnson and Johnson (1981), conducted a study in which controversy was compared to concurrence-seeking as the scripts that learners were to use. All of the students involved were given materials written from differing perspectives from which they were to write a group report. The students were initially given only one of the viewpoints to learn, and as the result of a series of activities, they came to be supportive of that viewpoint. Later they were put into one of two conditions. In the controversy groups, the learners were put in groups in which some of the other learners represented another viewpoint, and in discussing the issues, were told to commit themselves to one side. After this phase, then the learners were instructed to try to fully adopt the other viewpoint temporarily. These controversy groups were compared to groups in which the students were put into groups in which all controversy was avoided; that is, compromises were made whenever possible and arguments were not tolerated.

Smith, Johnson and Johnson (1981) found that students in the controversy groups outscored those in the concurrence seeking groups and that both outscored the individualistic (control) students. They conclude that conflict in groups can have "systematic and predictable constructive [learning] outcomes." Most notable is their finding that to be challenged in a group can have more positive learning outcomes than to avoid conflict for the sake of group productivity. It is in the challenge that the learning occurs, not in the perspective-adopting of seeking concurrence. Smith, Johnson and Johnson (1981) believe that in all cooperative groups, the learning begins with categorizing and organizing present information and experience in order to reach a conclusion. When challenging questions come up, however, the students then become uncertain about the correctness of their position or information, and actively search for more information, new experiences and a more adequate cognitive perspective. In defending their position, the students engage in cognitive rehearsal of their own position and attempt to understand the alternative positions of their peers, which results in a high level of mastery and retention of the material being learned. Uncertainty may also continue beyond the encounter in the peer group,

therefore prompting further motivation to learn about the issue of relevance. Thus, scripts that create a challenge to a learner's current perspective may promote a deeper engagement process. In fact, a meta-analysis of 92 studies involving controversy scripts v. concurrence-seeking scripts v. debates, showed the controversy scripts to be superior for learning outcomes (Johnson & Johnson, 1989).

Other Reconstructive Scripts: Cognitive Conflict and Cooperative Controversy

To this author's knowledge, there has been little systematic study involving cooperative learning situations in which the learners are formally instructed to engage in any form of controversy, beyond the research conducted by Johnson and colleagues (1989). In collaborative writing literature, there is mention of the concept of "cognitive conflict", however (Dale, 1992). Dale (1992) believes that cognitive conflict "seems to be a major factor in the success" of her coauthoring groups. Her description of the dialogue that takes place in the groups she has put together are in line with the reconstructive processes mentioned here.

In addition, Bredehoft (1991) introduces the notion of "cooperative controversies" and even illustrates a sample script for using one in a cooperative learning situation. In his script, the learners are given a controversial issue to discuss and students take sides either pro or con. They then engage in presenting their arguments to the other side, while the other side takes notes. Then the two sides switch. His notions are very similar to those put forth by Johnson and colleagues (1991) concerning structured academic controversies, but are more in line with the "debates" that Johnson and Johnson (1989) discuss. He does not have any research to back up his notions, but his idea is incorporated in the CECL model nonetheless.

Summary

The Cognitive Engagement in Cooperative Learning model presented here serves as a means of summarizing and integrating research related to the use of scripts in cooperative learning groups. Specifically, the model serves to illustrate how enhanced learning is the result of the type and amount of cognitive engagement involved in a particular cooperative learning script. Each of the studies reviewed here is included in the model, and should serve to provide a framework for the development of new scripts specifically tailored for desired learning outcomes. In other words, the evidence used to build the model suggests that those scripts which promote basic organizational strategies or simple elaboration techniques will not be as effective for learning as higher-level elaborative and reconstructive scripts.

Future Directions

Although this model can serve as a basis for the development of appropriate scripts, it is based primarily upon an integration of individual, somewhat piecemeal, studies, woven together according to a theoretical rationale. Future research that examines the relationships of the individual pieces should be conducted in order to strengthen the predictive utility of the model. For instance, one large study that used scripts that represented the continuum of cognitive processing would be most beneficial. In that way, some of the indirect and still theoretical comparisons between types of scripts could be analyzed more thoroughly.

The practical use of this model is to give instructors a broad idea of the types of learning outcomes to expect given certain scripts, and how to create their own scripts that take into account the depth, quality and amount of cognitive processing. In this manner, scripts can be streamlined to target the learning outcomes. For instance, the use of guided questioning holds tremendous promise for promoting effective learning using a relatively simple script (King 1989; 1990; 1991; 1992). On the basis of this scripts success, other scripts might be developed such as guided

discussion, or guided debate. Dees (1991) developed an effective script for problem solving that is marked by its simplicity, for it directs the instructor to undertake a series of minimal encouragements to promote the desired outcome. In this manner, the perceived drawbacks of occupying too much instructional time, or requiring a certain teacher or student personality can be addressed. Both Dees' (1991) script for problem solving and the guided questioning scripts, when used regularly over the course of the semester, became natural for the teacher and the students and nicely allowed for full coverage of the material (King 1989; 1990; 1991; 1992).

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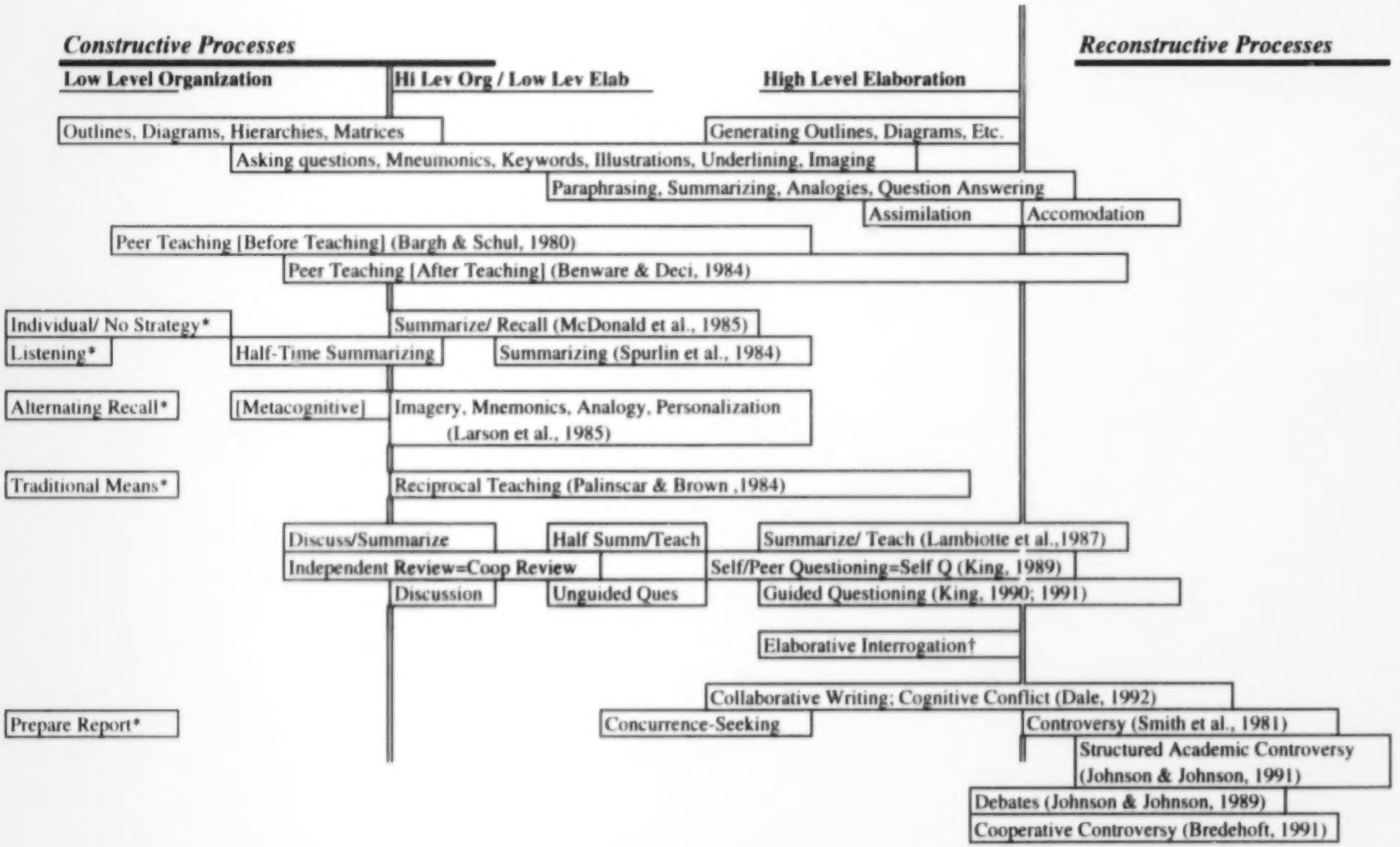

All items in the matrix are considered scripts for cooperative learning, with the following exceptions:

*Control group

†Not used in cooperative learning

Figure 1